STATE OF CALIFORNIA

resources AGENCY

Key Data Needs, Evaluation of Existing Data Sets And Identification of Important Data Gaps

California Continuing Resources Investment Strategy Project
(CCRISP)

The Resources Agency
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I. Executive Summary

This is the second in a series of 14 reports requested by the Joint Budget Committee of the California Legislature to insure that the Legislature has an opportunity for participation, direction, and evaluation of this important project, the California Continuing Resources Investment Strategy Project (CCRISP). This report evaluates the adequacy of existing data sets in meeting the key information requirements of the six-year project. It is part of the FY00/01 CCRISP Work plan and it expands on the initial data needs assessment included in the First Draft Report on Methodology to Identify State Conservation Priorities submitted to the Legislative Analyst Office by the Resources Agency on April 2, 2001.

The report initially summarizes CCRISP's information requirements, as described in the Methodology report. This information is described in terms of resources, drivers that affect those resources, and conservation opportunities. The report then establishes a framework by which to evaluate data, providing several criteria that describe ideal data sets for CCRISP's purposes. This evaluation was conducted using expert opinion from the California Biodiversity Council's Science Coordinating Committee (SCC), a multi-agency group representing State and federal agencies and the University of California, as well as follow-up interviews with several other experts that either manage or use data. Conducting such an evaluation for a variety of databases proved challenging, especially in attempting to reduce the complex nature of data sets and their suitability for a variety of uses into relatively simple terms for non-specialists.

The report provides a detailed table of all data sets that were evaluated, as well as a discussion of how each of CCRISP's information needs might be met by existing data sets. The data sets listed are only an initial list of data that will be useful for most types of conservation analyses and models. This list will be refined as CCRISP identifies more specifics about the new models that will be developed and the analysis conducted pursuant to those models.

In general, many data sets exist that will be fairly adequate for CCRISP's initial needs. Few of them, however, are considered excellent and even those are qualified by ranges of "good to excellent". The adequacy of these data sets needs to be more thoroughly evaluated as CCRISP identifies specific models and analyses. Even for most purposes, however, it is clear that several key data sets will need to be improved or to be developed to fill gaps in information. CCRISP's initial priorities for data improvement and development are described in the next section.

The report closes with a discussion of data needs, identified by both the SCC and an interagency Framework Data consortium, and describes some current actions CCRISP is undertaking to improve data.

II. Purpose

In response to a request from the Joint Budget Committee of the California Legislature, this report evaluates the adequacy of existing data sets in meeting the key information requirements of the California Continuing Resources Investment Strategy Project (CCRISP). The report is part of the FY00/01 CCRISP Work plan and expands on the initial data needs assessment included as Appendix C of the First Draft Report on Methodology to Identify State Conservation Priorities, submitted to the Legislative Analyst Office by the Resources Agency on April 2, 2001.

The report initially summarizes CCRISP's information requirements, as described in the Methodology report. It then establishes a framework by which to evaluate data, followed by a discussion of the adequacy of existing key data sets. The data sets listed are only an initial list, rather than an exhaustive list, of data that will be useful for most types of conservation analyses and models. This list will be refined as CCRISP makes a final selection of existing models and completes research and specification of the new models to be developed for this project. The report closes with a discussion of data needs and describes some current actions to improve data.

III. Context

As specified in the First Draft Report on Methodology to Identify State Conservation Priorities, CCRISP seeks to provide decision-makers with a statewide perspective on priorities for conserving important lands and natural resources (jointly termed "resources" in this report). To do this, CCRISP will need information about those resources, which include:

- High priority biodiversity lands, freshwater aquatic ecosystems and wetlands;
- Prime agricultural lands;
- Rangelands;
- Forest lands;
- Natural lands that can sustain outdoor recreational and educational facilities and pursuits and can accommodate visitors in a natural setting;
- Sites with significant natural cultural values (archaeological and paleontological resources);
- Critical watershed values;
- Urban open space with significant natural values or potential for significant restoration of natural values.

CCRISP will also need two other types of information to identify conservation priorities. The first type is information that helps assess which resources might be most at risk. Resources will be subject to varying levels and types of risk, depending on where they

occur and what activities or forces (termed drivers) affect them in those locations. Some of these drivers are direct human influences, such as expansion of urban or residential areas and changes in agricultural (cropland, grazing, and forestry) practices. Other drivers are more complex, such as climate change and invasion of exotic species.

The second type of information concerns opportunities that can be used to improve the status and trends of important resources. These opportunities include regional conservation and land use planning efforts, resource management activities, conservation funding programs (such as local assistance grants), acquisition efforts, outreach programs, and public support from constituents, elected officials, and property owners.

These three types of information often cannot be measured directly. Much of the desired information, such as "high priority biodiversity lands," "critical watershed values," or the potential influence of urban expansion, is a result of analyzing several databases that contain more measurable raw data, such as vegetation, hydrology, or existing land use. These data sets are processed through specific analyses, or models in some cases, that are based on specific objectives, measurable criteria, and weighting factors (see Figure 1).

This report provides an initial evaluation of existing data sets that will be needed to run the general types of analyses and models described in the methodology report (watershed models, ecosystem models, urban growth models, etc.). As the specific analyses and models are identified, CCRISP will have a more detailed understanding of its data needs. For now, however, CCRISP clearly will need data on at least the location and extent of resources, drivers, and opportunities, as well as the quality, health, and condition of resources at those known locations. This report focuses its evaluation on the adequacy of existing databases to provide this basic information.

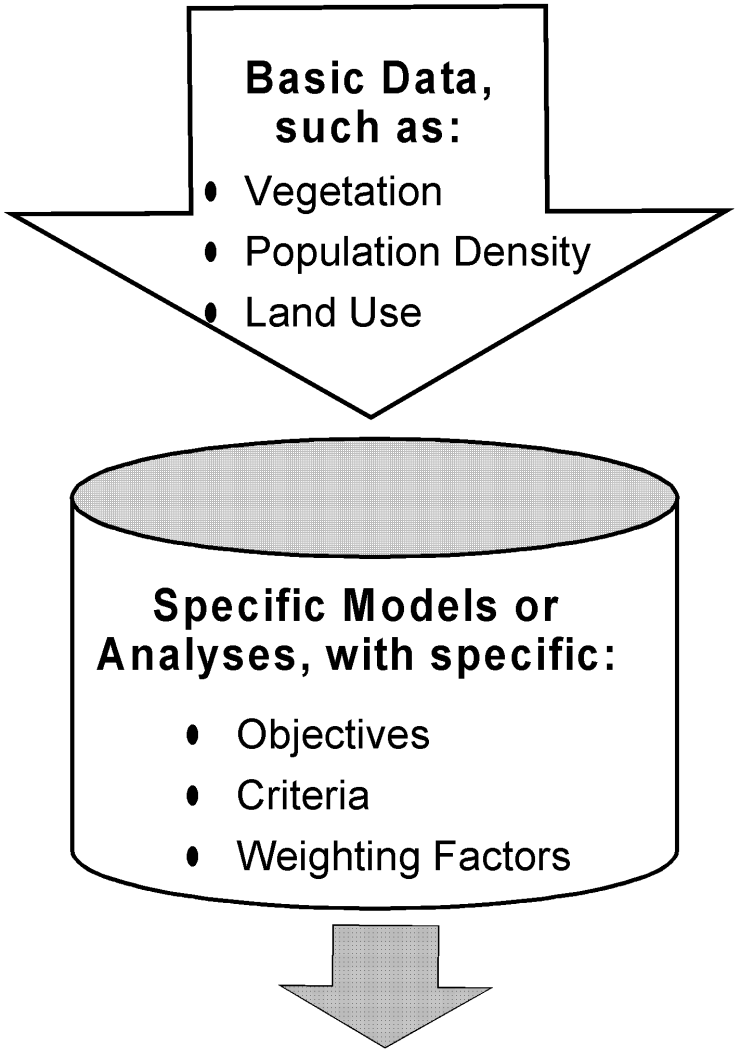
IV. Evaluation Process

This evaluation was conducted during April 2001, using expert opinion from the California Biodiversity Council's Science Coordinating Committee, a multi-agency group representing State and federal agencies and the University of California, as well as follow-up interviews with several other experts that either manage or use data. This set of specialists have backgrounds focused primarily on natural resources fields, such as biology or soils, rather than on topics such as urban planning, air and water quality, and toxics. A broader outreach effort is needed to evaluate more fully data sets that involve other aspects of environmental health and condition.

Conducting such an evaluation for a variety of databases proved challenging, especially in attempting to reduce the complex nature of data sets and their suitability for a variety of uses into relatively simple terms for non-specialists. These data sets have been, and continue to be, developed and maintained by many different public agencies,

Figure 1

Example of Turning Basic Data Into Desired Information



Desired Information, such as:

- Important Habitats at Risk from Urban Expansion

universities, and private organizations, each for specific purposes in mind, which may not necessarily parallel CCRISP's purposes. All of the data sets developed by public agencies are available to support CCRISP activities.

We established the following initial set of desirable characteristics to help focus and identify important data sets. These characteristics help guide the discussion about the relative strengths and limitations of each data set. As more specific models or analyses are identified, this evaluation will be reviewed, with greater outreach, to provide a more focused assessment using the following factors:

- Are statewide in scope
- Have contiguous (or uninterrupted) coverage across the state
- Are information rich
- Are GIS compatible (spatial, geo-referenced, and digital)
- Provide adequate resolution ("scale")
- Have high (or at least known) accuracy, and
- Are continually or recently updated

CCRISP will ideally need data sets that are **statewide in scope** so that all parts of the state can be addressed relatively consistently in analysis and modeling. In general, though, it is worth noting that data sets designed for statewide use are less precise and accurate than data developed at the local or regional level. Achieving high precision and accuracy for statewide data is expensive and has often not been sufficiently funded to reach these standards. Even with this relatively more consistent coverage, though, the quality of records in statewide data sets can vary from one location to another, depending on how the data set was created and updated, and on what ancillary or corroborative data were used in validating accuracy.

Contiguous (or uninterrupted) statewide coverage refers to providing data for every piece of land in the state, with one record being immediately adjacent to others. This is usually achievable for data sets that are based on remote imagery or that are catalogued by administrative units such as counties. Field-based data sets, such as sensitive species or cultural resources, are often based on individual observations at specific sites where surveys have been conducted. Contiguous coverage is usually not possible with these data sets.

Information-rich(ness) refers to data that contains considerable information about each particular record in the data set. Some data sets may merely provide a location and a name, whereas other data sets provide more detailed descriptions about individual locations. The relative value of this detailed information depends on the specific models or analyses that CCRISP will use. For the current evaluation, we focused only on information about the quality and condition of resources.

Data that is captured in a **Geographic Information System (GIS)** can be readily analyzed with other GIS data sets to evaluate and compare areas and to generate meaningful maps. The term “spatial” refers to the data being in the form of a map, as compared to a columnar table or text report. “Geo-referenced” means that records are linked to an actual coordinate on the ground. Some spatial data sets can be presented as maps, but unless they are geo-referenced, it is difficult to combine them with other data sets and remain confident that all records refer to the same spot on the ground. “Digital” refers to data being available in a computerized form, as compared to a paper-based source.

Resolution is the finest level of detail, or grain-size, at which the final products will be viewed. In popular language this is often referred to as “scale”, as in coarse-scale or fine-scale. The resolution of individual data sets varies considerably, ranging from mapping features as small as several meters in size up to simply tagging watersheds or counties as the unit-size for individual data records.

As these different data are combined in an analysis or model, a common minimum-size unit area (assessment unit) is needed to intersect or compare data. Individual data sets need, at least, to show variability at this common degree of detail (resolution) to produce meaningful results. For example, assume that common unit area is approximately 100 acres in size and that most of the data sets can detect variability at this resolution. A statewide data set showing total population per county, with one record per county, would not be able to show variability at this resolution any given 100 acres would be assumed, erroneously, to have the same average population as any other similar sized area. This coarse population data set would not be suitable for such an analysis.

The CCRISP methodology will select preferred geographic assessment units as specific models and analyses are identified, although the methodology already targets statewide, ecoregion and major watersheds as the correct scale to implement CCRISP (see examples in Appendix D). To guide the initial evaluation process, we assumed that an assessment unit at the resolution of about 30-40 square miles would be adequate, an area equal to townships or minor watersheds. Such a scale will help identify differences relatively equitably throughout the state and will serve as a useful guide to focus the attention of local conservation efforts.

Most statewide data provide at least this medium level of resolution. Levels of resolution that is significantly coarser or finer than this may not be appropriate for CCRISP. For example, on the fine end of the scale, parcel-level unit products, while potentially very useful, are not the intended assessment unit of the CCRISP methodology. Besides the fact that few statewide, or even regional, data sets provide this level of resolution, this fine scale of analysis is more appropriately conducted at project-level, or transactional level, planning, where local expertise and decision makers can provide greater field knowledge.

Accuracy is the degree to which computer data records (positive sightings or records only) reflect the actual presence of resources on the ground. Accuracy needs to be distinguished from resolution. Data can be quite coarse in resolution, but still highly accurate. For example, a total population size by county is coarse, but accurate, data. On the other hand, data can have very detailed resolution, but be quite wrong compared to field conditions. For example, a vegetation map could be so detailed that it picks out individual trees, yet if it maps the tree in the wrong location it has low accuracy.

Ideally, data sets should have 100% accuracy. As mentioned above, accuracy is the most difficult criteria to measure in simple terms as presented in this evaluation. Most data sets contain a wide variety of information, some of which is much more accurate than others. For example, a record could have high accuracy at identifying the type of road at one location, moderate accuracy in pinpointing the location, and poor accuracy at describing the traffic rate on that road. Data sets that rely solely on remotely sensed data are typically less accurate than field-based observational data due to errors in interpretation. This evaluation provides only a very cursory qualitative assessment of accuracy for these data sets. A major goal of CCRISP will be to obtain the best remote sensing data on a statewide basis to use for updating existing data sets and to create new sets. Another major goal will be to develop a cost-effective method of field sampling to ground-truth the data.

Data age is another aspect of, and is often directly related to, accuracy. Older data are often more inaccurate than more recent data. Ideally data should be always up-to-date, but this is expensive also. For dynamically changing information, the most useful data sets will be less than 3 years old in areas of rapid changes in land use (such as urbanizing areas) and less than 5-7 years in other parts of the State. Use of data much older than this often produces erroneous or meaningless results. For other information that changes rarely, such as county lines, data can be much older in age and still be acceptable for use.

V. Results Summary

This evaluation was conducted in a relatively short time period (one month), in a relatively informal manner, by approximately 30 people from 13 state or federal agencies and the University of California. We identified approximately 150 data sets, or groups of data sets, that seemed to have the desirable database characteristics described above. Of these, the natural resource specialists who helped with this evaluation were sufficiently familiar with 80-plus data sets. Each of these 84 data sets was evaluated in terms of their relative strengths and weaknesses (see detailed descriptions in Appendix A). The remaining 70 or so data sets that were not evaluated are listed in Appendix C. Although seemingly comprehensive, these data sets represent only a small portion of existing data sets, many of which are either more localized in nature or focused on other topics. Appendix E (not available with every copy due to bulk) provides a more comprehensive listing of other data sets currently

catalogued in the CERES Environmental Information Catalog. This information is also available online at http://gis.ca.gov/catalog.

At the relatively coarse resolution of 30-40 square miles, much of the data listed in Appendix A will be marginally to fairly adequate for CCRISP's initial purposes. These data sets are not sufficient for more detailed planning, such as currently being conducted under the Natural Community Conservation Planning approach or at the project-level. The major reasons for these inadequacies are less-than-comprehensive field surveys for field-based, observational data sets and limited ground-truthing for remote imagery-based data sets.

The adequacy of these data sets needs to be more thoroughly evaluated as CCRISP identifies specific models and analyses. At present, however, it is obvious that several key data sets will need to be improved or to be developed. These priorities for data improvement and development are described in the next section of this report.

The following summary is organized by key information needs identified at the beginning of this report. For each type of information, we identify the most useful data sets and summarize important strengths and limitations. Appendix A provides detailed information on all of the key data sets evaluated in this effort.

A. Resources Information

1. High priority biodiversity lands, freshwater aquatic ecosystems and wetlands

A variety of data sets will be important to identify biodiversity lands and ecosystems, including those that provide information on species (sensitive, game, and fisheries), habitats (both upland, wetlands, and aquatic), and water quality. Data sets exist for most of these topics, and they were judged to range from poor to good in adequacy.

Databases for species range from providing precise location information for field observations to broad species distribution range maps. The most useful statewide data set for identifying locations of sensitive species and habitats is the California Natural Diversity Data Base (CNDDB), covering more than 35,000 locations of rare or sensitive species and habitats (see example in Appendix D). Most of the records have been updated within the past five years to a resolution of at least 1:24,000, with resolutions often of less than 100 acres. It provides quality and condition information for approximately one-third of all records. CNDDB does not represent a comprehensive statewide survey of all sensitive species locations. It provides positive sightings records only where surveys have been conducted, some of which are relatively comprehensive surveys for specific areas or species. Because most of this survey activity is related to environmental review or academic research, records are skewed toward areas of rapid land use change, where access is easiest (i.e., public lands), and proximity to roads and

university researchers. This is actually true for many other field-observation-based data sets as well.

Other databases with sensitive species information make useful complements to CNDDB, but alone they provide less complete or less detailed location information. The California Wildlife Habitat Relationships data provides statewide distribution maps for all terrestrial vertebrate species (amphibians, reptiles, birds, and mammals, but not fish), as well as considerable life-history information on each species. This information is available only at the full-species level and overlooks distinctions between important, biologically rare, subspecies. The CalFlora database provides statewide distribution maps, locations of herbarium collections, and other ecological information for all plant species in the State, including invasive exotic species.

Data on the distribution of and important areas for game birds and mammals is available for only a few, higher profile species. These data are in a variety of species-specific databases with different data structures, but probably could be easily integrated into a statewide analysis.

Data on fish species is best captured by the UCD Aquatic Diversity data sets, although this provides primarily information on each species distribution among major tributaries ranges, rather than detailed information about each tributary. More detailed information on specific locations exists primarily at field offices throughout the State and cannot be readily integrated into a statewide analysis.

The Gap Analysis Program's (GAP) vegetation data set is currently the most complete data for vegetation and land cover across the entire state (see example in Appendix D). This program is part of a nationwide biological analysis program sponsored by the USGS. The California portion of this program, which developed statewide vegetation and public ownership data, was developed by the University of California, Santa Barbara. The GAP data set is relatively coarse (minimum polygon size is 250 acres) and has accuracy problems. It also lacks some of the canopy closure (percent of ground covered by vegetation) and age class (such as, sapling vs. old-growth) information important for habitat modeling. The USFS/CDF vegetation data set provides improved resolution and accuracy, as well as information valuable for habitat modeling. However, it does not cover the entire State. Other regional data sets, such as San Diego Association of Governments vegetation, are more precise and accurate and preferred at the regional planning level.

The USFS/CDF Land Cover monitoring data set provides information about change in land cover over time for most of the state, except crop agriculture areas, desert areas, and urbanized areas. All areas are evaluated on a five-year cycle, providing quantitative measures of canopy.

Data sets for aquatic habitats, including wetlands, riparian, rivers and streams, are not available on a contiguous, statewide basis. Data sets for wetlands, such as the

National Wetlands Inventory and the DFG/Ducks Unlimited data, are most advanced for the Central Valley and parts of the Central and South Coast, but even these data sets have some accuracy problems. Riverine habitat data are best captured by the California Rivers Assessment data set that is maintained by Information Center for the Environment at the University of California, Davis.

Water quality information is provided in a variety of formats. The State Water Resources Control Board's 303(d) list of impaired water bodies has been linked to watershed data, converting this tabular data into a GIS compatible format. The National Aquatic and Water Quality Assessment is very detailed but limited in coverage. USEPA's Storage and Retrieval of US Waters (STORET) data ranges considerably in quality, with many data gaps.

2. Prime agricultural lands

The most important data to identify prime agricultural land is soils data, of which the NRCS Soil Survey Geographic (SSURGO) data set is the most detailed data set in California. It is not yet available in a digital GIS format for the entire state, but hard-copy maps for the state are available. Until that digitizing is completed, the best statewide data is the NRCS State Soils Geographic (STATSGO) database. STATSGO data is considerably coarser (1:250,000) than the SSURGO data (1:24,000) and provides only generalized soil categories.

The Department of Conservation uses soils data in its Important Farmlands data set. This Important Farmland also includes information on various land uses. It is not complete statewide, primarily because the soils data are not currently available statewide and the program focuses on the loss of important farmland.

3. Rangelands

Identifying important rangelands will rely on existing land cover data (see above), as well as data on the relative productivity of those range lands. Data is not readily available to display relative productivity on a statewide level. BLM and USFS have digitized the boundaries of their grazing allotments, but this data is not digitally linked to stocking level data contained in land management plans. Probably the best equivalent for grazing on private lands is the 1987 report Agricultural Census Special Tabulation: Livestock Operations in California. However, this information is not GIS based nor available statewide.

4. Forest lands

Identifying important forestlands will rely on existing land cover data (see above), as well as data on the relative productivity of those forest lands. Timber productivity is fairly well captured in the CDF Timber Production Zone data and the USFS Forest Inventory data.

5. Natural lands that can sustain outdoor recreational and educational facilities and pursuits and can accommodate visitors in a natural setting

Recreation data was not adequately evaluated in this report and requires more research and involvement of recreation and environmental education experts from the Department of Parks and Recreation (DPR) and the State conservancies.

6. Sites with significant natural cultural values (archaeological and paleontological resources)

The DPR State Office of Historic Preservation (SHPO) Cultural Information Centers provide a statewide database of national, state, and locally significant archaeological and historical locations. Digital mapping of this data is currently limited to the Central Coast, San Diego County, San Francisco Bay Area, and the Mojave Desert area. Discussions have been initiated with the California Archeological Association to engage them in whether or how this information can be safely and appropriately included in CCRISP.

7. Critical watershed values

Important data for identifying critical watershed values includes fisheries data (see above), water quality data (see above), hydrology, and watersheds. Calwater watershed boundary information and National Hydrologic Data at 1:100000-scale are important data sets that need significant refinement.

8. Significant urban open space

Important data for identifying urban open space is land cover (see above), roads for access (see below), and land use (see below), as well as existing or historic natural values.

B. Information about Drivers or Activities that Affect Resources

1. Expansion of urban or residential areas

Important data for identifying urban expansion are land cover (see above), existing land use, adopted land use plans, land ownership and parcels, topography, projected population sizes and density, projected commercial uses, jobs and recreational uses, and existing and projected roads and other forms of transportation..

The most complete and best quality statewide land use data set is from the California Department of Water Resources. This data set is relatively high quality and relatively

precise, but it is updated by county only once every 5-8 years. The US Bureau of Reclamation is currently developing a more detailed land use data set, but this effort is focused only on the Central Valley. The 2000 Census data provides statewide data on population and housing density, a useful indicator of both urban growth potential and rural residential areas.

Planned land use is available through county general plans and land management plans by public land-managing agencies, such as the USFS or BLM. County general plans are generally available in GIS formats only for urbanized counties. The zoning information in these county general plans is subject to regular changes by amendments and specific plans. This data will be most easily incorporated into statewide analysis after it is converted to uniform classifications. Such an effort will be a formidable challenge for CCRISP.

Land cover change detection is being conducted by the California Department of Forestry and Fire Protection and the USDA Forest Service. This program uses Landsat Thematic Mapper (TM) satellite imagery to map land cover types and derive land cover changes across all ownerships. A large portion of the State is covered in five unique project areas that are individually updated every fifth year. The resulting change map depicts vegetation cover increases and decreases, coverage of known causes for change areas and an annual statistical report documenting the area and effects of land cover change. Final mapping products from this program include species groupings, tree size, and tree canopy closure with a minimum map unit of 2.5 acres. Over 60 percent of the State is currently covered and the rest of the State is scheduled for completion soon (excluding croplands, deserts and urban areas).

Land ownership/easement information is one of the most rapidly changing data sets related to conservation planning. Public land ownership data are most accurate and up-to-date in those data sets managed by individual agencies. Two statewide data sets on ownership have compiled this information during the past 10 years. The Teale Data Center database provided basic information on State and federal lands, with some local government lands also included. The Gap Analysis Program ownership data set expanded on the Teale data by including more local government lands and providing some management status information, such as National Wilderness designations, for State and federal lands (see example in Appendix D). Both of these data sets are now being updated in a multi-agency effort led by BLM and USBR.

Individual counties generally maintain parcel-specific information, one of the most important data sets for local government, usually in a variety of different formats, scales, and data structures. Several urbanized, or urbanizing, counties have converted this data into a GIS format, but many have not done so. Some data users have found that private vendor data on parcels are occasionally more reliable than local government digital products.

Data on paved and unpaved roads are available in a variety of formats, although users have low expectations of the consistency and quality of any existing data sets. Private vendor data are generally considered better than public agency data for urban areas and the USFS road data set is better than others for road data sources on USFS lands.

Because of the natural resource focus of evaluators, other important planning data were not evaluated in this report. Projections for changes in population size and density are available from the Demographic Research Unit of the California Department of Finance. County general plan data probably contains information about projected commercial uses, jobs and recreational uses. The California Department of Transportation will be a good source for projected roads and other forms of transportation.

2. Changes in agricultural (cropland, grazing, and forestry) practices

Important data for identifying changes in agricultural practices are land cover, land ownership, land use plans (see above for all of these).

3. Effects of climate change

Important data for identifying effects of changes in climate are land cover (see above), topography (see above), seasonal and typical daily wind patterns, precipitation and temperature, and land ownership (see above). CCRISP will be looking at information produced by climate change experts and modelers. However, we have not evaluated data sets for their usefulness in existing or future climate change models.

4. Changes in fire or flooding regimes

CDF and USFS have some historical digital data (or some that is being digitized) showing the distribution of fires in California. FEMA (and other agencies) have developed floodplain maps for much of California. However, because the landscape is changing rapidly---due to urbanization and other land use changes---and hydrologic and flood modeling is constantly improving, floodplain mapping has to be updated.

5. Invasion of exotic species

Invasive species are not clearly inventoried in any one individual data set. CalFlora and the California Wildlife Habitat Relationships (CWHR) data are useful to identify the ranges of nonnative plants and animals, but specific infestations are not mapped on a statewide basis. The Department of Food and Agriculture has a database focused on exotic plant species, insects, and animals that have an effect on agriculture, but this is only a partial listing and not inclusive of many major exotics that have a large impacts on natural aquatic and land habitats.

C. Conservation Opportunities Information

1. Regional Conservation and Land use Management and Planning efforts

Regional planning efforts have made significant strides in developing regional data sets and in working collaboratively with others to identify priority conservation areas. CCRISP needs to know where these efforts are located and what progress they have made in identifying priorities. The Department of Fish and Game has developed a simplified GIS coverage of all Natural Community Conservation Plans (NCCPs), federal Habitat Conservation Plans (HCPs), and major watershed and landscape projects. This data set only identifies the names and boundaries of each planning area, with more detailed information available in manual files.

UC Davis, in conjunction with many State and federal agencies, maintains the Natural Resource Project Inventory, an online directory of hundreds of conservation planning projects, ranging from local habitat restoration efforts to major regional conservation efforts.

D. Other Opportunity Information

CCRISP will probably need information on a variety of other conservation opportunities, such as available funding programs; agency acquisition efforts; public outreach programs; and public support from constituents, elected officials, and property owners. Although this is valuable information, such information is usually not contained in spatial databases. The feasibility of digitizing conservation opportunities by type and location will be evaluated as CCRISP progresses.

VI. Priorities for New or Improved Data

As mentioned earlier, some of CCRISP's specific needs for new or improved data will depend on which specific models or analyses are eventually selected. However, evaluation of the existing data linked to CCRISP Conservation Priorities point to some clear needs, and agencies have already been engaged in identifying priorities for new data. In general, while CCRISP will not be using data at the transactional level, new data sets and most of the existing data sets eventually need to be refined to the parcel level. This is the critical level at which land use decisions are often made and local planners depend heavily on such precise data.

Priorities for new or improved data have been identified through CCRISP staff, the California Mapping Coordinating Committee (CMCC), and the California Biodiversity Council's (CBC) Science Coordinating Committee.

The California Mapping Coordinating Committee was re-established by the Resources Agency in 1999 to foster collaboration, both within and outside of State government, on the development and use of geographic data, services, and technologies in pursuit of better public service. This Committee is coordinating a process to develop basic data needed for a multitude of purposes. The development of this framework data is a concept endorsed by the Federal Geographic Data Committee (FGDC) and being carried out in many states (see Appendix B). California agencies are interested in eventually developing all of the FGDC Framework data layers. But the CMCC has identified a set of priority data sets that need development or improvement.

The CBC's Science Coordinating Committee identified important data development and improvement needs as part of the CCRISP Scoping Committee in May 2000. This current evaluation process continued to substantiate that the priorities have not changed over the past year.

The priority data themes are described below (with both sets of priorities):

A. Framework data

1. Vegetation/Habitats/Land Cover

This data is essential for identifying the location of important habitats, assessing the extent of current urban and agricultural areas, and running models for wildlife and land use changes. The land cover data being improved by the Framework data approach needs to be expanded to include other considerations such as biophysical conditions important for wildlife, such as habitat structural elements (snags, cliffs, etc.), and finer classifications of wetlands and other rare habitats. This data also needs to include substantial field validation and additional information on species composition. This goes significantly beyond current data capacity on vegetation, habitats, and land cover.

2. Public Land Ownership/Parcels/Management Status/Land Use

This type of data is important to help identify appropriate conservation actions for any given piece of land. It is also a very rapidly changing type of data and will require an ongoing commitment to keep up-to-date. A statewide data set also would ideally integrate with local government parcel data. Many local government agencies have parcel boundary information, land use maps, land management information, and Assessor Parcel Number databases. However, they typically do not have all of these sources in digital spatial form, and, by and large, do not have them linked. The framework effort has a goal of working cooperatively with local governments to convert these sources into digital spatial information and link them together.

3. Hydrography (Rivers, Lakes)

This data is currently being improved as part of a National Hydrographic Database effort. 1:24000 NHD is fundamental to many of the programmatic needs of water quantity and quality, water rights, flood control, data for decisions by fish and game managers, and several other federal, State, and local natural resource management agencies, This data set is key to improving the watershed boundaries coverage described below. The USGS and its federal and local partners are working to improve small portions of the State from 1:100000-scale NHD to 1:24000. However, detailed 1:24000-scale hydrography is missing for approximately 70 percent of California, a significant data gap.

4. Roads/Transportation

Roads are important to evaluate potential risks from urbanization, human access that may disturb sensitive wildlife, and degradation in water quality due to increased sedimentation from unpaved roads. Various coverages exist, each with different strengths and weaknesses. But no comprehensive road coverage exists, and an improved statewide data set would be more useful. The California Department of Forestry and Fire Protection is in the process of capturing roads in its areas of responsibility for rural fire protection, but extensive work remains to be done to capture and share existing urban, rural, and local road information.

5. Geodetic Control

This data is important for ensuring accurate and consistent spatial referencing of digital geographic information. Efforts to improve this data are being coordinated by Caltrans and the California Spatial Reference Center.

6. Topography

Topography is captured digitally in the form of Digital Elevation Models (DEMs). Approximately 50 percent of the 10-meter DEMs have been completed for the State. USGS is slowly adding models with its federal and local partners. With sufficient funding, the framework effort could complete this data within one to three years.

7. Imagery

High resolution aerial photography/satellite imagery is important for capturing much of the framework data described above (i.e., roads, vegetation/land cover, hydrography and to support the revision of all-purpose topographic maps). It needs to be statewide, in color, at a resolution of 1-meter (or better) and orthogonal (views perpendicular to ground). Black and white (and some color) Digital Orthophoto Quarter Quads (DOQQ), essentially imagery of areas covering an area one-quarter of the size of standard USGS

7.5 degree topographic maps, is available for much of the State. However, most of this imagery is outdated, ranging from 1993 to 1998, and black and white images are difficult to use for detailed vegetation mapping.

B. Other CBC's Science Coordinating Committee Data Priorities

1. Fisheries

Statewide databases are only available for a few species. Most of the data are currently distributed throughout many field offices and universities. These data have been collected in many different formats and will be challenging to integrate into one data set. Additional funding will help coordinate existing data collection and provide more direction to data collectors to adhere to standards.

2. Sensitive Species

Existing data sets are not based on comprehensive statewide field surveys. They provide information on positive sightings only, and those sightings are only where field workers have worked in the course of other activities. Additional field survey work is needed to both identify new locations, as well as monitor population trends at all locations, of sensitive species. Innovative solutions will be needed to incorporate this new information into the existing California Natural Diversity Data Base, along with integrating data from other, more localized or agency-specific databases.

3. Watershed Boundaries

The statewide Calwater watershed boundary data set—developed cooperatively by several State and federal agencies---needs to be improved in areas of relatively flat topography. Local hydrological expertise and information will be required to create smaller, more refined watershed polygons. The "natural" flow of water in many areas of California has been altered by human intervention. Water diversions and conveyance systems, flood control structures, groundwater pumping, roads and other built features have changed the direction and rates of water flows in the Central Valley and many other "flat" landscapes in the State. Consequently, local experts must be involved in delineating these smaller watershed boundaries.

4. Land Use

Land use data describes the existing use of the land, as compared to the existing ownership. For example, privately owned lands can be used for mining, timber harvest, crops, or grazing. This information help identify existing risks as well as appropriate conservation actions for specific lands. Like the ownership data, this data changes frequently and it will require an ongoing commitment to keep up-to-date.

5. Soils

Soils data is important for identifying agricultural productivity (in the broad sense including timber and range), for predicting environmental variability in vegetation, and for identifying sensitive or highly erodible soils. The existing effort to digitize the NRCS Soil Survey Geographic (SSURGO) database needs to be completed throughout the State.

VII. Current Actions to Improve Data

CCRISP is initiating work on data development with this year's funding. Projects currently being contracted are:

- **State and Federal Land Ownership/Easements** - Contractors will work with CCRISP Staff and other cooperating agencies to update and improve a coverage of public agency land ownership and easements;
- **Fire History Data** - Contractors will work with CCRISP Staff and other cooperating agencies to compile and update the Statewide GIS fire history data set;
- **Local Agency Open Space/Conservation Lands** - Contractors will work with CCRISP staff, UC Santa Cruz, and willing local agencies to develop a cost-effective methodology for creating a statewide GIS data set of local government parks, open space, and conservation lands. This includes information on approximately 2,700 open space and conservation land parcels, information that is currently in a wide variety of different formats and locations. The product will be:
    - A written description of one or more approaches to creating a single GIS data set containing open space/conservation lands.
    - A proof of concept example of each approach.
    - A list of willing participants (primarily Counties) in providing geographic information that will be incorporated into a statewide GIS data set.
    - A cost and time estimate to capture approximately 2,700 known open space/conservation areas according to the prescribed approaches.

VIII. Next Steps

This summary of existing data sets is valuable information for the next steps of CCRISP methodology refinement. Knowledge of these data sets will help ensure that CCRISP selects initial models and analyses that can take optimal advantage of what already exists.

Among the next steps needed, CCRISP needs to continue working with its partners to develop and improve priority data sets. Long-term priorities are listed above. In the

short-term, a second round of CCRISP funding will build on recommendations from the Resources Acquisition Project sponsored by the Resources Agency in Fall 2000. This includes:

- **Habitat Linkages** - Enhancing existing data sets on habitat linkages allowing migration of species between major natural land areas.
- **Open Space Ranking** - Implement existing methodologies to locate and rank urban open spaces, producing a set of maps detailing open space in terms of size, proximity to population, redundancy.
- **Management Landscapes** – The California Department of Forestry has developed a statewide management landscapes map that combines public ownership and generalized land uses (residential, agricultural, etc.). This map helps to illustrate differences between, for example, public lands in reserve status versus public lands under more intensive resource management activities. This map will be updated to improve classification of existing public lands.

In addition, CCRISP will take the following next steps:

- Identify specific models and analyses, assess their specific data needs (including resolution levels), then conduct a more refined evaluation of existing data sets for their adequacy in meeting these needs.
- Develop a broader understanding of State and federal agency data needs and priorities and work with them to identify and evaluate relevant databases, particularly for environmental health and condition.
- Work with local government and the private sector to identify their specific data needs and to seek their assistance in evaluating data sets, improving field validation, and developing high priority data sets.

Appendix A

Detailed Evaluations of Key Data Sets*

A. Natural Resources

Data Base Name	Data Manager	Strengths	Limitations	Resolution	Age
Sensitive Terrestrial Species (T&E, other rare)					
California Natural Diversity Data Base http://www.dfg.ca.gov/whdab/cnddb.htm	DFG	Statewide GIS; constantly updated; good accuracy and quality control; most comprehensive inventory in State; includes records for sensitive/rare subspecies	not contiguous coverage; positive sightings only; backlog of records not digitized; access issues; skewed toward public lands where access and surveys and areas of active land use changes or natural resource activities; quality and condition information is incomplete and often missing	1:24000	Ongoing
DFG species-specific databases	DFG	Statewide for individual species; regularly updated	only for select species (mostly forest species; varying formats; not contiguous coverage; positive sightings only; poor outside commercial timberlands	various	ongoing
California Wildlife Habitat Relationships (CWHR) wildlife range maps http://www.dfg.ca.gov/whdab/cwhr/whrintro.html	DFG	Statewide GIS; comprehensive for all native terrestrial vertebrates in state; contains other non-map-able information linked to wildlife habitat models	Full-species only (no subspecies information); Coarse range maps that could be refined using WHR habitat models, given an adequate spatial vegetation coverage; not very precise/accurate on sensitive species distribution	Varies ~1:1 million	ongoing
CalFlora http://elib.cs.berkeley.edu/calflora	UCB/ USFS/ CNPS/ Calflora NGOs	Statewide; only data set of all plant species in State. Long time series in herbarium collections; contains other non-map-able information	Not contiguous coverage; positive sightings only; geo-location is highly variable; museum/herbarium specimens are not representative of habitats	varies	ongoing

*Evaluations for CCRISP purposes.

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A. Natural Resources

Data Base Name	Data Manager	Strengths	Limitations	Resolution	Age
NRIS Fauna http://www.fs.fed.us/emc/nris/fsveg/	USFS		only for USFS land; consists of observations/occurrences from individual surveys; not all species comprehensively surveyed; not spatial; incomplete and in various uncompiled sections	varies	Ongoing
Sensitive Fisheries (T&E, other rare)					
California Natural Diversity Data Base	DFG	Statewide GIS	weak on fisheries; not contiguous coverage; positive sightings only; backlog of records not digitized; access issues; skewed toward public lands where access and surveys and areas of active land use changes or natural resource activities; quality and condition information is incomplete and often missing	1:24000 or better	Ongoing
UCD Aquatic Diversity databases	ICE	Statewide; covers all native fish species	distribution ranges only		Ongoing
NRIS Water (Aquatic Species)	USFS		only for USFS land; consists of observations/occurrences from individual surveys; not all species comprehensively surveyed; not spatial; incomplete and in various uncompiled sections	varies	Ongoing

*Evaluations for CCRISP purposes.

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Detailed Evaluations of Key Data Sets*

A. Natural Resources

Terrestrial Game Species					
California Wildlife Habitat Relationships (CWHR) wildlife range maps	DFG	Statewide GIS; comprehensive for all native terrestrial vertebrates in state; contains other non-map-able information linked to wildlife habitat models	Full species only (no subspecies information); Coarse range maps that could be refined using WHR habitat models, given an adequate spatial vegetation coverage	~1:1 million	Ongoing
DFG species-specific databases	DFG	Statewide GIS; comprehensive for all native terrestrial vertebrates in state; contains other non-map-able information	only for select species; varying formats	various	Ongoing
Inland Fish Harvest Species					
UCD Aquatic Diversity databases	ICE	Statewide; covers all native fish species	distribution ranges only	varies	Ongoing
NRIS Water (Aquatic Species)	USFS		Only for USFS land; consists of observations/occurrences from individual surveys; not all species comprehensively surveyed; not spatial; incomplete and in various uncompiled sections	varies	Ongoing

*Evaluations for CCRISP purposes.

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A. Natural Resources

Rare Terrestrial Habitats (including riparian)					
California Natural Diversity Data Base	DFG	Statewide GIS; most comprehensive inventory of rare terrestrial habitats in state	Coverage is sporadic and not contiguous; misses many important rare habitat locations (riparian, wetlands); access issues; skewed toward public lands where access and surveys and areas of active land use changes or natural resource activities; quality and condition information is incomplete and often missing	1:24000 or better	Ongoing
Rare Aquatic Habitats (including wetlands)					
California Natural Diversity Data Base	DFG	Statewide GIS	coverage is sporadic and not contiguous; misses many important rare fisheries and rare aquatic communities; this is weakest part of CNDDB; info. needs to be expanded and updated; skewed toward public lands where access and surveys and areas of active land use changes or natural resource activities; quality and condition information is incomplete and often missing	1:24000 or better	Ongoing
DFG/Ducks Unlimited Wetlands *http://maphost.dfg.ca.gov/wetlands*	DFG	GIS; relatively contiguous coverage for area covered	S. F. Bay and Central Valley only; limited accuracy assessment; resolution very limited for riparian habitats; not useful for special wetlands, such as vernal pools	30-meter pixel resolution	1993

*Evaluations for CCRISP purposes.

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A. Natural Resources

National Wetlands Inventory http://www.nwi.fws.gov	FWS	Statewide; relatively contiguous coverage; good around Bay Area	digital for only 3/4 state; somewhat outdated information; not useful for special wetlands, such as vernal pools	1:24000	1988 (some recent additions to areas not captured earlier)
DFG/FWS Vernal Pools http://maphost.dfg.ca.gov/wetlands/	FWS	GIS; relatively contiguous coverage for area covered	Central Valley only; does not delineate individual vernal pools	30-meter pixel resolution	1993
Critical Habitats for Select Species Groups					
Critical Game Habitat (wintering, breeding, migratory)	DFG	Statewide for selected species; GIS	Coarse resolution; discontinuities in data between counties; best for migratory deer habitat	various	ongoing
T&E Critical Habitat	FWS	Statewide for selected species; GIS; good information on what FWS deems essential for recovery of species	Based on combination of ecological habitat needs of species and regulatory/administrative constraints	various	Ongoing
All Vegetation and Habitat Types					
CDF/USFS Vegetation Mapping Program	USFS/ CDF	GIS; contiguous coverage; recently updated; provides good canopy closure and structure information; accuracy assessment on all project areas; provides quantitative changes in canopy cover; provides trend information; all ownerships and vegetation types; monitors patterns in urban development; identifies tree mortality	doesn't cover Central Valley or deserts; classification emphasizes forested habitats; needs refinement for wildlife habitat modeling; some data not accurate; and species composition data are too general	30-meter resolution	In progress

*Evaluations for CCRISP purposes.

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A. Natural Resources

California Landcover Mapping and Monitoring Program http://frap.cdf.ca.gov/projects/land_cover/index.html	USFS/ CDF/ USBR	GIS; contiguous coverage; recently updated; provides good canopy closure and structure information; accuracy assessment on all project areas; provides quantitative changes in canopy cover; provides trend information; all ownerships and vegetation types; monitors patterns in urban development; identifies tree mortality	doesn't cover deserts; not developed at same time frame; classification emphasizes forested habitats; needs refinement for wildlife habitat modeling; some data not accurate; and species composition data are too general	30-meter resolution	In-progress
Gap Analysis Program Vegetation http://www.dfg.ca.gov/whdab/gaporder.htm	UCSB/ DFG	Statewide coverage; GIS; contiguous coverage	Very coarse resolution; poor in wetlands and riparian and other smaller rare habitats (not part of design); very little accuracy assessment; no habitat structure information; multiple attributes of vegetation per polygon	Min. mapping unit is 250 acres, but usually more than 1000 acres	1993
Weislander 1930-1945 historical vegetation http://www.mp.usbr.gov/mp400/geopage/metadata/weisland.html	SCS/USFS/UCB/ USBR	provides historical benchmark; GIS; contiguous coverage	Generalized plant communities; covers only a portion of State (not in desert); non-forested areas are more generalized than woodland areas	1:100000	1945

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Kuchler Potential Natural Vegetation http://www.mp.usbr.gov/mp400/geopage/metadata/kuchler.html	USFWS	Statewide coverage; indicates historical and potential vegetation; contiguous coverage; GIS	Very coarse; not GIS; generalized plant communities	1:250000	1976
All Aquatic Habitats (rivers, lakes, streams)					
California Rivers Assessment http://endeavor.des.ucdavis.edu/newcara/	DFG/ICE (UC Davis)	Statewide assessment of riverine habitats; GIS	Aggregation of incomplete data	1:100000 or better (generally by river reach on a planning watershed basis)	Ongoing
Water Quality					
SWRCB 303(d) list - Impaired Water bodies http://www.swrcb.ca.gov/tmdl/303d_lists.html	SWRCB	Statewide; can be linked to watershed data to make GIS-compatible	Inconsistent & incomplete application of standards	1:250,000	1993
USEPA Safe Drinking Water Information System - California Sourcewater Assessment http://www.epa.gov/safewater/sdwisfed/sdwis.htm	EPA/ DHS	Location data and hazards for all public drinking water sources in California	Limited hazard information; some inconsistency in spatial accuracy of wells	mostly hundreds of meters	Ongoing

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A. Natural Resources

USEPA Storage and Retrieval of US Waters Parametric Data (STORET) http://www.epa.gov/OWOW/STORET/	EPA		Wide range in quality and location information; many gaps in data	mostly hundreds of meters	Ongoing
USGS National Aquatic and Water Quality Assessment (NAWQA) http://water.usgs.gov/nawqa/	USGS	Very detailed	Limited coverage; limited by specifications - random sampling with 5-yr. repeat		Ongoing
Watershed Boundaries					
CALWATER ftp://maphost.dfg.ca.gov/outgoing/itb/calwater/readme.txt	USGS/ NRCS	Statewide GIS; contiguous coverage; the only statewide data on watersheds	Several inaccuracies in database; poor in areas of low topographic relief (Central Valley) and deserts; smaller polygons need to be more hydrologically based	Hierarchical - based on 1:24000	2001
Hydrography					
Groundwater http://www.waterplan.water.ca.gov/groundwater/gwindex.htm	DWR	Nearly statewide; GIS		Based on 1:250,000 geologic maps	2000

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A. Natural Resources

1:100000-scale National Hydrographic Data http://nhd.usgs.gov/	USGS	Statewide GIS; contiguous coverage; River names and flow direction	Not adequate for detailed modeling and analysis	1:100000	In-progress
Flooding					
FEMA 100-yr floodplains *http://msc.fema.gov/MSC/q3flooda.htm*	FEMA		Somewhat outdated	1:24000	varies
FEMA Dam Inundation Areas	BOR		Data not widely available; focused on specific areas	1:24000 or better	varies
NRCS Soil Survey	NRCS	Records flood hazard for each soil type		1:24000	Ongoing
Sensitive/Highly Erodible Soils					
DOC Landslide Hazard data http://www.consrv.ca.gov/dmg/pubs/sp/120/sp120.pdf	DOC	Consistent classification; field-verified	Focused mapping; not statewide; North Coast	1:24000	Ongoing
NRCS Highly Erodible Soils	NRCS		Most in paper form at NRCS county offices	1:24000	
Highly Erodible Watersheds	DOC	Ranks erosion risks based on slope, precipitation, and lithologic susceptibility to failure.	Most in paper form at NRCS county offices	Hierarchical - based on 1:24000	1994

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A. Natural Resources

All Soil Types					
DOC Important Farmlands http://www.consrv.ca.gov/dlrp/FMMP/index.htm	DOC	GIS; contiguous coverage; provides info on cultivated agriculture, grazing, and urban land use; maps90% of private land in state; 44.1 million acres; this is the only private land use survey conducted in the state at two year intervals; Database completely updated every two years; excellent urban data layer	not statewide; some important areas missing (that don't have modern soil surveys)	1:24,000 and 1:100,000	2000 update in progress
NRCS Soil Survey Geographic (SSURGO) database http://www.ftw.nrcs.usda.gov/soils_data.html	NRCS	Most detailed level of soil mapping done by NRCS; descriptions of the soils, maps of their locations, and a discussion of soil suitability, limitations, and overall management concerns for specified uses	not statewide; some important areas missing	Varies (1:24000)	Ongoing
NRCS STATSGO (State Soils Geographic database)	NRCS	Statewide GIS; contiguous coverage	generalized categories of soil; minimum area mapped is 1500 acres	1:250000	Ongoing
Timber Productivity					
CDF Timber production zones	CDF				
USFS/PSW Forest Inventory	USFS	GIS; highly detailed in NW Forest Plan; many attributes collected annually or periodically	not continual coverage; data for isolated plots; point data only		Ongoing
Rangeland Productivity					
BLM/USFS Grazing Allotments	BLM/ USFS	Allows linkage of stocking levels data in plans to GIS; all BLM lands	Business process information only		

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A. Natural Resources

1987 Agricultural Census Special Tabulation: Livestock Operations in California	DOC	Reports values for 317 variables for 18 different farm types or aggregations of farm types in 17 different regions in California.	Not GIS; not statewide	1:24,000 and 1:100,000	2000 update in progress
DOC Important Farmlands	DOC	GIS; contiguous coverage; provides info on cultivated agriculture, grazing, and urban land use; maps 90% of private land in State; 44.1 million acres; only private land use survey conducted in the state at two-year intervals; database completely updated every two years; excellent urban data layer	not statewide; some important areas missing (that don't have modern soil surveys)	1:24,000 and 1:100,000	2000 update in progress
Historical or Archaeological Resources					
DPR State Office of Historic Preservation (SHPO) Cultural Information Centers *http://ohp.parks.ca.gov/*	DPR	Statewide database of national, State, and local significant public & private cultural, archeological, and built environment resources. Queries can be rendered by USGS quad, county, or city. Information retrieved by agency or spatially.	Digital mapping limited to Calif. Coast, San Diego, S.F. Bay Area, Mohave Desert area. Digital records limited to Mojave & Bay Area. All records since 1998 a digital PDF. Positive sightings only; often not precise enough for projects	varies	Ongoing
Areas of Scenic Beauty or Visual Quality					
National Wild and Scenic Rivers *http://energy.er.usgs.gov/products/openfile/OF95-631/PLATE3/text.htm*	USGS	Statewide; GIS; some Wild & Scenic rivers are linked to National Hydrologic Data	Coverage may not be complete	1:100000	Unknown
Scenic Highways	CalTrans			1:100000	Ongoing

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Detailed Evaluations of Key Data Sets*

B. Drivers that Affect Natural Resources

Data Base Name	Data Manager	Strengths	Limitations	Resolution	Age
Land Use					
Land Use data	BOR	GIS; improved accuracy assessment	In- progress; Central Valley only	30-meter pixels	In progress
DWR Land & Water Use Mapping http://www.waterplan.water.ca.gov/landwateruse/indexlawu.html	DWR	GIS; High quality ground-truthing; assesses agricultural, urban, and environmental water uses, and evaluates supplies	Limited to every 5-8 years by County	1:24000	Varies (Several Counties In progress)
National Landcover database http://edcwww.cr.usgs.gov/doc/edchome/ndcdb/ndcdb.html	USGS	Statewide; GIS; contiguous coverage;	Very limited detail in national classification scheme; somewhat outdated	Based on 30-m pixels	mid-1990s
Land Use/Land Cover data (GIRAS/LULC) http://nsdi.usgs.gov/products/lulc.html	USGS	Statewide; GIS; contiguous coverage; recently updated in 2000 Census	Very limited detail in national classification scheme; outdated	1:250000 (10-acre cells)	1980s
TIGER urbanized areas, housing/population density http://www.census.gov/geo/www/tiger/index.html	Census	Statewide; GIS; contiguous coverage; recently updated in 2000 Census	Density is based on very rough estimates of actual jurisdictional size supplied by the cities and counties to the State Board of Equalization; substantial error potential without a statewide jurisdictional boundary survey that is regularly updated to account for boundary changes.	1:100000	2001
Planned Land-use (zoning, land-use plans, etc.)					
County general plans	Counties	Statewide; no other choice on data for local zoning	spatially digital only in urbanized counties; data changed frequently by amendments and specific plans; not currently tracked by the state.	varies	various

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Detailed Evaluations of Key Data Sets*

B. Drivers that Affect Natural Resources

Data Base Name	Data Manager	Strengths	Limitations	Resolution	Age
BLM land management plans	BLM	Statewide for BLM lands; GIS; no other choice on data for BLM planned land use	not all plans provide specific prescriptions or planned uses to help identify risks	varies	various
USFS land management plans	USFS	Statewide for USFS lands; GIS; no other choice on data for USFS planned land use	not all plans provide specific prescriptions or planned uses to help identify risks		various
Roads					
Functional Class Roads - Caltrans	Caltrans	Statewide; GIS; contiguous coverage	Federal funding-related roads only (State highways & major local arterials); little information on the width of actual roads or right-of-ways ; roads are a major source of impermeable surfaces that change drainage patterns in urbanizing or ex-urban watersheds	1:24000	2000
TIGER roads file *http://www.census.gov/geo/www/tiger/index.html*	Census				2000
USGS Teale county roads (1:100K) http://www.gislab.teale.ca.gov/meta/majrdsa.txt	USGS/ Teale	Statewide; GIS; contiguous coverage; good in urban areas; several classes of transportation features including jeep trails, city streets, thoroughfares, unpaved roads, state highways, and interstates.	sporadic accuracy; poor for non-paved roads	1:100000	Ongoing
Thomas Brothers (private vendor)	Private	Statewide; GIS; contiguous coverage	not very complete outside urban areas		Ongoing
GDT (private vendor)	Private	Statewide; GIS; contiguous coverage	not very complete outside urban areas		Ongoing

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Detailed Evaluations of Key Data Sets*

B. Drivers that Affect Natural Resources

Data Base Name	Data Manager	Strengths	Limitations	Resolution	Age
ETAK (private vendor)	Private	Statewide; GIS; contiguous coverage			Ongoing
USFS Cartographic Feature Files - Roads	USFS	Statewide; GIS; very detailed; best currently available for all USFS lands	USFS lands only	1:24000	Varies by Forest
USFS Infrastructure - Travel Routes	USFS	GIS; very detailed; best available for USFS lands	USFS lands only; will be complete for all USFS lands by Oct 2001	1:24000	In-Progress
Water Impoundments and Diversions					
Dam Safety Program http://damsafety.water.ca.gov/ *(older spatial data coverage can be found at http://elib.cs.berkeley.edu/dams/)*	DWR	Covers jurisdictional dams in California 6 feet or greater in height (and over 50 AF storage) and dams over 25 feet (and over 15 AF storage)	Does not cover dams that are no longer functional (sedimented)		1998 update - Ongoing
National Inventory of Dams http://nationalatlas.gov/damsm.html	COE/FEMA	Statewide GIS	Only dams 50 feet or higher	1:2000000	1996
Water rights data http://www.waterrights.ca.gov/WRInfo/	SWRCB	Statewide GIS			Ongoing
Invasive/Nuisance Species					
Agricultural Field Border Database	Dept. of Pesticide Regulation	Provides detailed database of pesticide application, crop, date of use, and location	Still under development	1:24000	ongoing
CalFlora	UCB	Statewide; covers wide variety of non-native invasive plants	Not GIS or contiguous coverage	varies	Ongoing

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Detailed Evaluations of Key Data Sets*

B. Drivers that Affect Natural Resources

Data Base Name	Data Manager	Strengths	Limitations	Resolution	Age
California Wildlife Habitat Relationships (CWHR) wildlife range maps	DFG	Statewide; GIS; contains other non-map-able information	Provides info on only a few non-native terrestrial vertebrates; coarse range maps that could be refined using WHR habitat models, given an adequate spatial vegetation coverage	varies	Ongoing
MAB Fauna	ICE		Only available for selected parks		
Mining					
Abandoned Mines http://www.consrv.ca.gov/omr/index.htm	DOC	Statewide; GIS; relatively contiguous coverage	Not all mines covered; only a portion of mines field verified	1:24000	Ongoing
SMARA Active surface mines http://www.consrv.ca.gov/dmg/index.htm	DOC	Mostly statewide GIS	Only covers those mines reported	Precision of Placement varies (digitized from 1:24K)	Ongoing
Mineral Resources Zones http://www.consrv.ca.gov/dmg/other/minerals/index.htm	DOC	Consistent classification; field mapped	Selected areas only	Varies (1:24000 to 1:100000)	Ongoing

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Detailed Evaluations of Key Data Sets*

B. Drivers that Affect Natural Resources

Data Base Name	Data Manager	Strengths	Limitations	Resolution	Age
Air Pollution					
Non-Attainment Areas http://www.arb.ca.gov/homepage.htm (Ozone example: http://www.gislab.teale.ca.gov/meta/caloza.txt)	Air Resources Board	Statewide GIS; contiguous coverage	Relationships between air quality and terrestrial biodiversity/ aquatic biodiversity and agriculture, rangelands and timberland productivity still in research stages		Ongoing

Database Name	Data Manager	Strengths	Limitations	Resolution	Age
Land Ownership/Easements/Management Status					
Post-Teale Public Lands Ownership (Fee & Easements)	BLM/USBR/Teale	Statewide GIS; contiguous coverage	misses majority of local government lands and state school lands; not up-to-date; no management status information; accuracy sporadic; not useful below section level	1:100000	2001 in progress
Gap Analysis Program Public Lands Ownership	DFG/UCSB	Statewide GIS; contiguous coverage; provides management status info	outdated; management classes inconsistent	1:100000	1994
Agency-specific land ownership	various	Statewide GIS; contiguous coverage for specific agency; the most up-to-date ownership info for agencies	public lands only	1:24000 to 1:100000	varies
County parcel data (cadastral)	Counties	Statewide contiguous coverage	Not all GIS; quality varies by county; lots of proprietary data; private sector data more reliable	1:24000 and better	varies

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Detailed Evaluations of Key Data Sets*

C. Other Conservation Planning Data

Database Name	Data Manager	Strengths	Limitations	Resolution	Age
Geographic Coordinate Database http://www.ca.blm.gov/cadastral/gcdb.html	BLM	High accuracy GPS measurements associated with section corners	Only portion of the State has been completed	GPS Coordinates – sub-meter accuracy for Section corners	ongoing
Public Land Survey (PLSS) http://www.gislab.teale.ca.gov/meta/plsa.txt	BLM/ Teale	Statewide GIS; contiguous coverage; depicting the township, range and sections contained in the Public Land Survey System	Does not include Land Grant and Overflow lands; inaccuracies	1:100000	1997
Existing natural resource planning or management field projects					
Regional Conservation Plans (HCP, NCCP, CRMPs)	DFG	Statewide GIS; relatively contiguous coverage; covers all NCCP/HCPs, major CRMPs	Only provides outline of planning areas	1:100,000 approx	ongoing
Natural Resources Project Inventory	ICE	Statewide; covers 100s of field conservation, mitigation, and restoration projects throughout State	Not all data spatially digital; needs updating	varies	ongoing
Existing Local Natural Resource Institutions					
Watershed Groups Inventory (ICE)	ICE	Statewide; covers many watershed groups statewide	not spatially digital; needs updating	Not spatially digital	ongoing
Remote Imagery (Satellite, Air photo)					

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Detailed Evaluations of Key Data Sets*

C. Other Conservation Planning Data

Database Name	Data Manager	Strengths	Limitations	Resolution	Age
Landsat 7	NASA	Statewide GIS; contiguous coverage	Most be orthorectified	30-meter resolution	Ongoing
SPOTView Panchromatic	SPOT Image Corp.	Statewide GIS; contiguous coverage	not adequate for detailed change detection; black & white	10-meter	1998-2000
USGS Digital Ortho Quarter-Quads (DOQQs) http://mapping.usgs.gov/www/ndop/	USGS	Statewide GIS; contiguous coverage	Very large files to move around and work with on the desktop computer; most images are black and white	1 to 2 meters	varies
Individual Agency Air Photo Collections (DOC, BLM, BOR, Coastal Comm., Farm Services Agency, NRCS Historical Collection)	various	Photos may go back to 1930s; DOC has begun to digitize U-2 aerial photos (1980s to 2000)	Mostly not digital; data sporadic - varies by field office	varies	various
Administrative/Jurisdictional Boundaries (local, state, federal)					
COGs/LAFCOs		Statewide GIS; contiguous coverage		Varies	various
Teale (assembly/senate districts, etc.) (Assembly District example: *http://www.gislab.teale.ca.gov/meta/caloza.txt*)	Teale	Statewide GIS; contiguous coverage; most up-to-date coverage	Out of date	1:100000	To be updated with 2000 Census data
Urban Services Boundaries				varies	various
Topography					

Appendix A

Detailed Evaluations of Key Data Sets*

C. Other Conservation Planning Data

Database Name	Data Manager	Strengths	Limitations	Resolution	Age
Digital Elevation Models/National Elevation Data *http://rmmcweb.cr.usgs.gov/elevation/*	USGS	GIS; 30-meter DEM contiguous coverage	10-meter resolution not complete statewide	10-meter	Ongoing
Geodetic Control					
Geographic Coordinate DataBase	BLM	GIS; contiguous coverage; high accuracy GPS measurements associated with section corners	Only portion of the State has been completed	Sub-meter	Ongoing
National Geodetic Survey http://www.ngs.noaa.gov/	NGS/ NOAA	GIS; continuous coverage; high accuracy	Limited statewide coverage	Sub-meter	Ongoing

APPENDIX B

Federal Geographic Data Committee Framework Data

The development of framework data is a concept endorsed by the Federal Geographic Data Committee (FGDC) and being carried out in many states (http://www.fgdc.gov/framework). Framework data typically represent the best available data for an area, certified, standardized, and reliable for intended uses. Cooperative data management provides many benefits to stakeholders and the public including better and faster data access, more reliable and useable data and more interchangeable information products. In addition to providing accessible and reliable base-map data sets, framework data that have been developed as part of a single system expressly for the support of critical uses will be easily integrated for analysis and will conform to existing standards. These qualities will allow multiple agencies to communicate without confusion in the assessment of a single situation for their respective actions, such as in a disaster or for management of a region in which there are several jurisdictions in operation.

Framework Data layers or themes defined by the FGDC are:

- **Orthoimagery** – aerial photography or satellite imagery that has been ortho-rectified to real-world coordinates on the ground;
- **Elevation** – or topography, generally referred to as Digital Elevation Models (DEMs) of ground surface;
- **Transportation** – typically includes roads, highways, rail lines, etc.;
- **Hydrography** – rivers, lakes, canals, and other water bodies;
- **Governmental (or Administrative) units** – for example, county boundaries
- **Cadastral (or Parcel) information** – land record or parcel boundary & ownership information;
- **Geodetic control** – high resolution ground location information; often used by surveyors and scientists as reference points for collecting location information of other features.

These seven themes of geographic data are those that are produced and used by most organizations. Various surveys indicate that they are required by a majority of users, form a critical foundation for the National Spatial Data Infrastructure (NSDI), and have widespread usefulness. A cooperative approach to producing and sharing these common data benefits that most organizations use is geographic data. In some instances, the US Geological Survey will provide cooperative funding with state and local governments to complete these layers.

The framework consists of many data sets that are, or can be, integrated and related to each other and to other data. Participants may contribute or use any data theme for any geographic area.

California Framework Data Development

The California Mapping Coordinating Committee (CMCC) is comprised of both management and technical representatives from various boards, departments, offices, conservancies, and commissions (BDOCCs) throughout California State government that use Geographic Information System (GIS) technology. The Resources Agency resurrected the CMCC in 1999 after several years of inactivity, and increased participation by reaching out to other agencies. It is the intent of the CMCC to foster collaboration within and outside of State government, on the development and use of geographic data, services, and technologies in pursuit of better public service. This proposal is in keeping with a draft strategic plan currently being advanced by the California Mapping Coordinating Committee, which recommends the development of a coordinated California Geographic Information Infrastructure (CGII). Development of California Geographic Framework Data is one of several important steps toward implementation of the CGII.

California agencies are interested in developing all of the FGDC Framework data layers. But, in the near-term, the CMCC is particularly interested in finding funding and partners to develop the following framework data layers:

- **Orthoimagery** – new statewide imagery at 1-meter or better accuracy; high-resolution imagery is a fundamental data set that many levels of government and the public use for locating and classifying other framework data such as roads, conducting land use planning and environmental impact analyses, and many other public purposes.

- **Roads** – state-wide roads coverage at 1:24,000-scale or better.

- **Elevation** – state-wide 10-meter DEM coverage.

- **Hydrography** – National Hydrologic Data (NHD) for California at 1:24,000-scale or better.

- **Vegetation/Land Cover** – though not strictly a FGDC Framework data set, a statewide vegetation/land cover map using a minimum mapping unit of 2.5 acres or better, is critical to the programmatic needs of several agencies including the California Dept. of Forestry and Fire Protection, Dept. of Water Resources, Office of Emergency Services, Dept. of Fish and Game, and Dept. of Parks and Recreation as well as, several Federal agencies including Bureau of Land Management, Bureau of Reclamation, Forest Service, Natural Resources

Conservation Service, and National Parks Service, and many local government entities.

- **Cadastral (or Parcel) information** – a statewide land record information spatial database at 1:24,000 or better that includes data on parcel boundaries, ownership information, and land use.

APPENDIX C

Other Data Sets Needing More Research

Theme / Database Name	Database Manager
A. Resources	
Sensitive Terrestrial Species (T&E, other rare)	
Breeding Bird Survey	USGS/BRD/USFWS
Christmas Bird Counts	National Audubon
Point Reyes Bird Observatory data sets	PRBO
Partners in Flight databases	
USGS/USFS Declining Amphibians (Jennings/Fellers)	USGS/USFS
Sensitive Fisheries (T&E, other rare)	
California Academy of Sciences	CalAcad
UC Museum of Vertebrate Zoology	UCB
NMFS carcass counts	NMFS
Terrestrial Game Species	
Breeding Bird Survey	
Christmas Bird Counts	
Point Reyes Bird Observatory data sets	PRBO
Inland Fish Harvest Species	
California Academy of Sciences	CalAcad
UC Museum of Vertebrate Zoology	UCB
NMFS carcass counts	NMFS
Common Animal Species	
California Wildlife Habitat Relationships (CWHR) wildlife range maps	DFG
NRIS Fauna	USFS
MAB Fauna	DPR/ICE
California Academy of Sciences	CalAcad
UC Museum of Vertebrate Zoology	UCB
NPFauna (National Parks)	ICE
CalstateFauna (State Parks)	DPR/ICE
Breeding Bird Survey	
Christmas Bird Counts	
Point Reyes Bird Observatory data sets	PRBO
Partners in Flight databases	
UCD Aquatic Diversity databases	ICE
NMFS carcass counts	NMFS
Common Plant Species	
CalFlora	UCB
NPFlora (National Parks)	ICE
CalstateFlora (State Parks)	ICE
Critical Habitats for Select Species Groups	
Important Wildlife Habitat Structural Elements (snags, cliffs, caves, etc.)	
Important Animal Movement Corridors	
Water Quality	

USEPA National Sediment Inventory	EPA
DWR Municipal Water Quality Investigations — Delta and tributaries	DWR
DWR Non-Point Source Pollution	DWR
DWR Soil and H2O Quality Assessment	DWR
Flooding/Flood Control	
DWR River/Tide Forecast	DWR
DWR California Data Exchange Center	DWR
DWR NFIP Floodplain Mapping	DWR
FEMA Dam Inundation Areas	BOR
Flood Control Levees/Berms	DWR/COE/FEMA
Water Supply	
DWR California Data Exchange	DWR
DWR Precipitation/Snow	DWR
DWR Reservoir Data	DWR
DWR Snowpack Status	DWR
DWR Volunteer rainfall measurements (500+ stations)	DWR
USGS National Aquatic and Water Quality Assessment (NAWQA)	USGS
DWR Ground water data	DWR
Wildland Fires	
Ignition (strikes)	CDF
CDF/USFS Fire Perimeter data	CDF/USFS
OES Fire data	OES
BLM Fire History data	BLM
CDF/USFS Fire History	CDF/USFS
Geological/Paleontological Features	
Forest Inventory Analysis (FIA)/Monitoring (FIM)	USFS

B. Drivers or Activities

Land Use	
CEQA Actions Projects	OPR
Cropland data	CDFA
Timber Harvest	
Forest Inventory	USFS
Timber Harvest Plans	CDF
Water Impoundments and Diversions	
NHD Larger Dams	USGS
Small Dams and Impoundments	NRCS
Invasive/Nuisance Species	
Breeding Bird Survey	
California Academy of Sciences	CalAcad
CDFA Exotic Plants	CDFA
Christmas Bird Counts	
MAB Fauna	ICE
National Agricultural Pest Information System (NAPIS - USDA)	USDA
NRIS Fauna	USFS
UC Museum of Vertebrate Zoology	UCB
Recreational Activities	
5-year Wildlife Recreation Reviews	FWS
Angler Surveys	DFG
Division of Off-Highway Vehicles	DPR

Hunting Recreation data	DFG
Recreation Information Management System (RIMS)	BLM

C. Other Planning Data

Remote Imagery (Satellite, Air photo)	
Alexandria Digital Library	UCSB
UCB Digital Library	UCB
UCSB Map and Imagery Library	UCSB
Climate (Temperature and Rainfall)	
DWR Precipitation/Snow	DWR
DWR Reservoir data	DWR
DWR Snowpack Status	DWR
DWR Volunteer Rainfall Measurements (500+ stations)	DWR
NOAA's National Climatic Data Centers (NCDC) Weather Data	NOAA
Population Density	
2000 Census	Census Bureau
Housing Density	
2000 Census	Census Bureau
Educational Levels	
2000 Census	Census Bureau
Employment Income	
2000 Census	Census Bureau

Appendix D

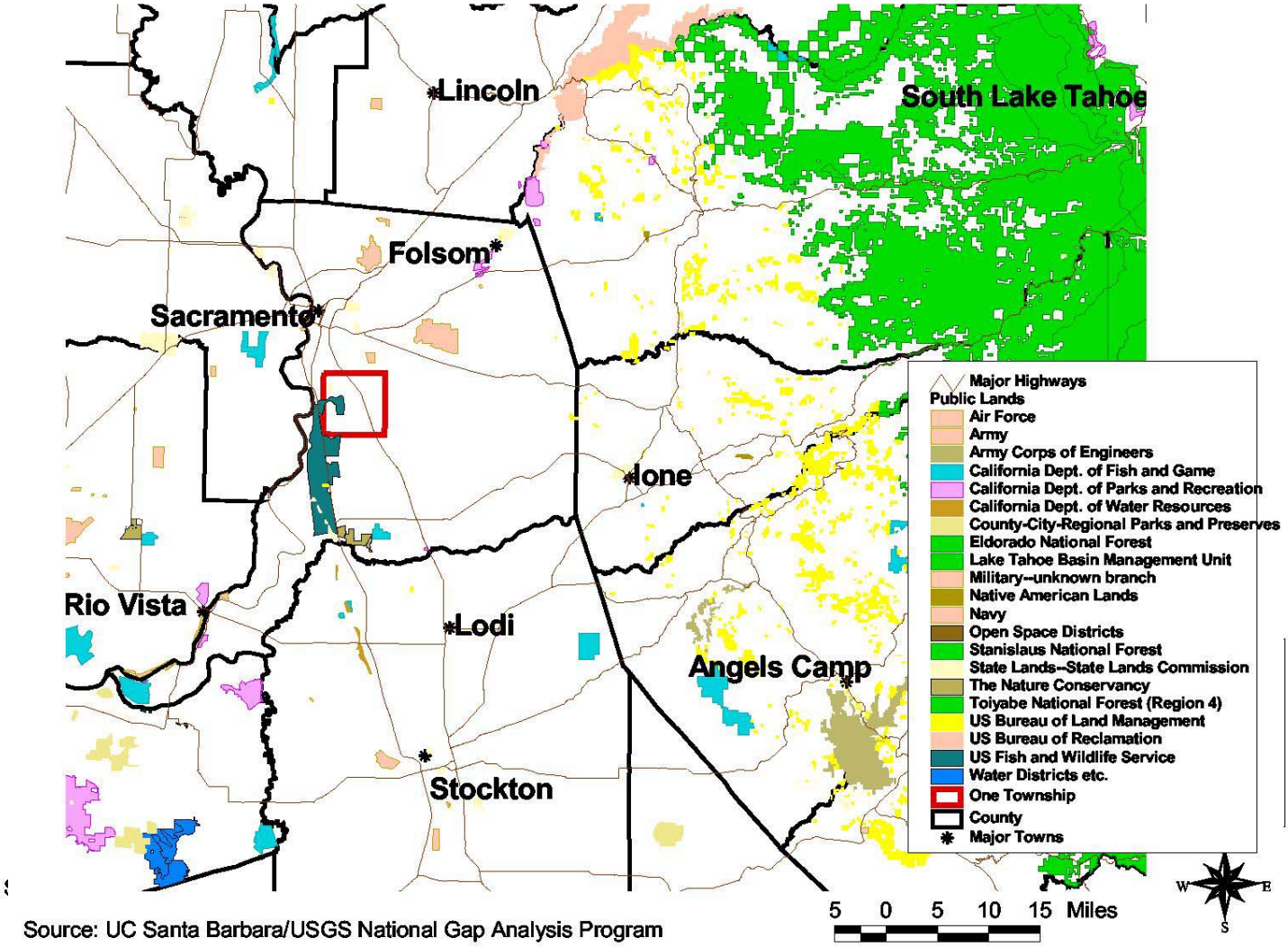
Examples of Assessment Unit Types and Spatial Data

The following maps are included as examples to illustrate resolution of some statewide databases:

- **Examples of Assessment Unit Types in the Sacramento Region** – This map shows examples of different assessment units that CCRISP could use for modeling and analyzing statewide data sets.
- **Detail of GAP Vegetation in Sacramento Region** – This map shows the degree of resolution provided by the statewide vegetation data coverage produced by the University of California, Santa Barbara as part of the USGS-sponsored National Gap Analysis Program (GAP). A single township is also displayed as an example of an assessment unit for resolution comparison.
- **Detail of GAP Ownership in Sacramento Region** – This map shows the degree of resolution provided by the statewide public land ownership data coverage produced by the University of California, Santa Barbara as part of the USGS-sponsored National Gap Analysis Program (GAP). A single township is also displayed as an example of an assessment unit for resolution comparison.
- **Detail of NDDB Special Species and Natural Communities in Sacramento Region** – This map shows the degree of resolution provided by the statewide Natural Diversity Data Base (NDDB) coverage, managed by the California Department of Fish and Game. A single township is also displayed as an example of an assessment unit for resolution comparison.

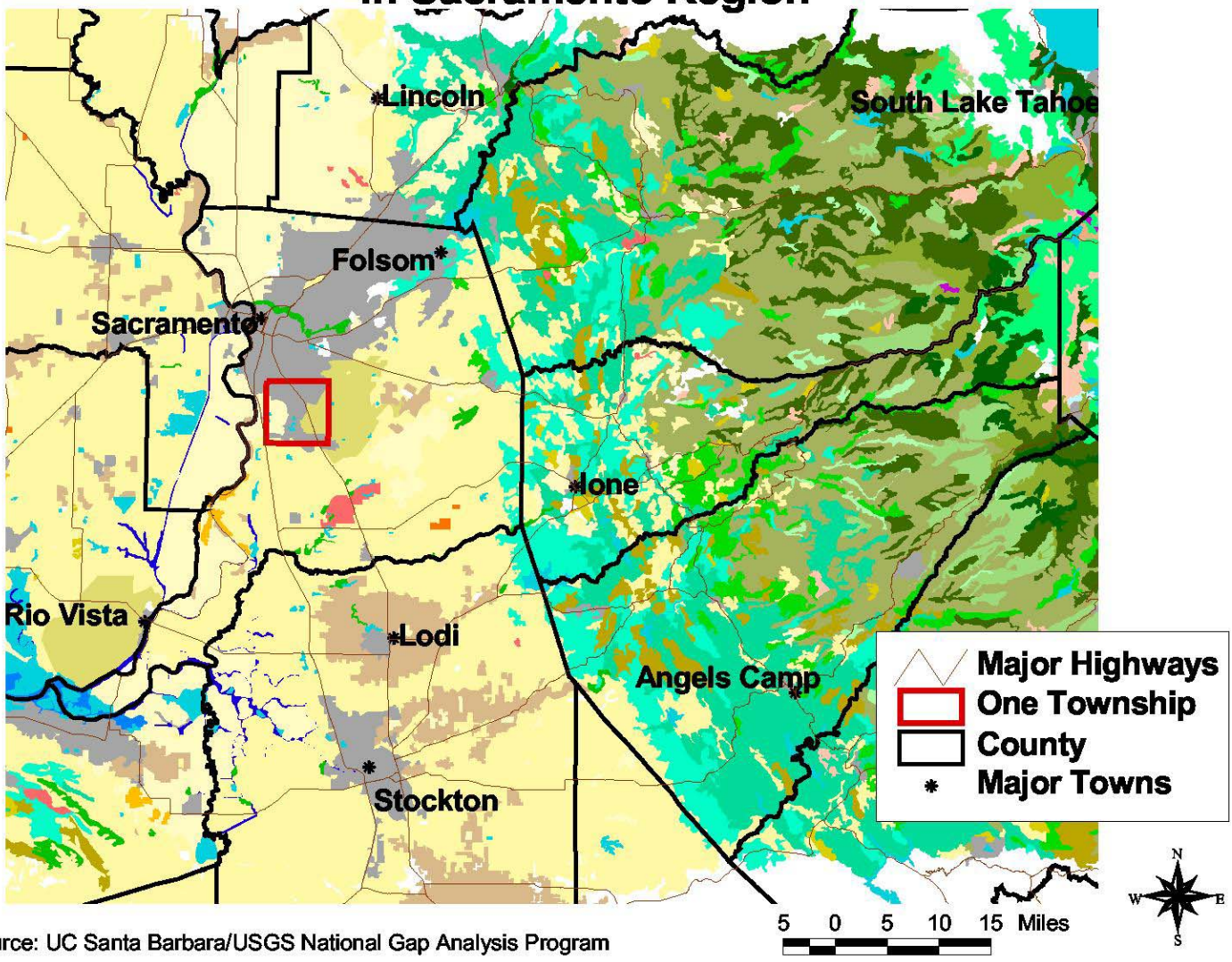
Examples of Assessment Unit Types

Detail of GAP Public Ownership in Sacramento Region



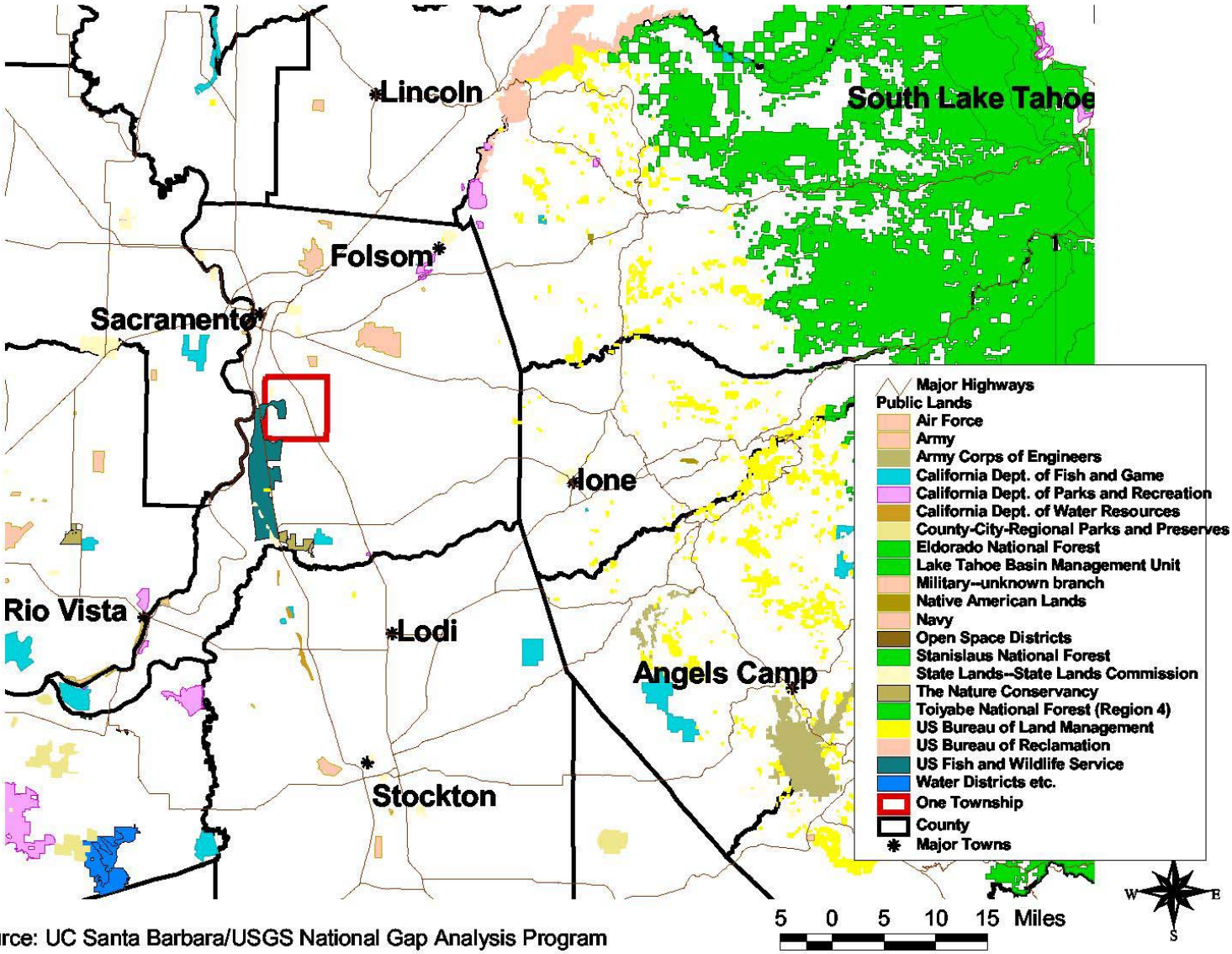
Source: UC Santa Barbara/USGS National Gap Analysis Program

Detail of GAP Vegetation in Sacramento Region



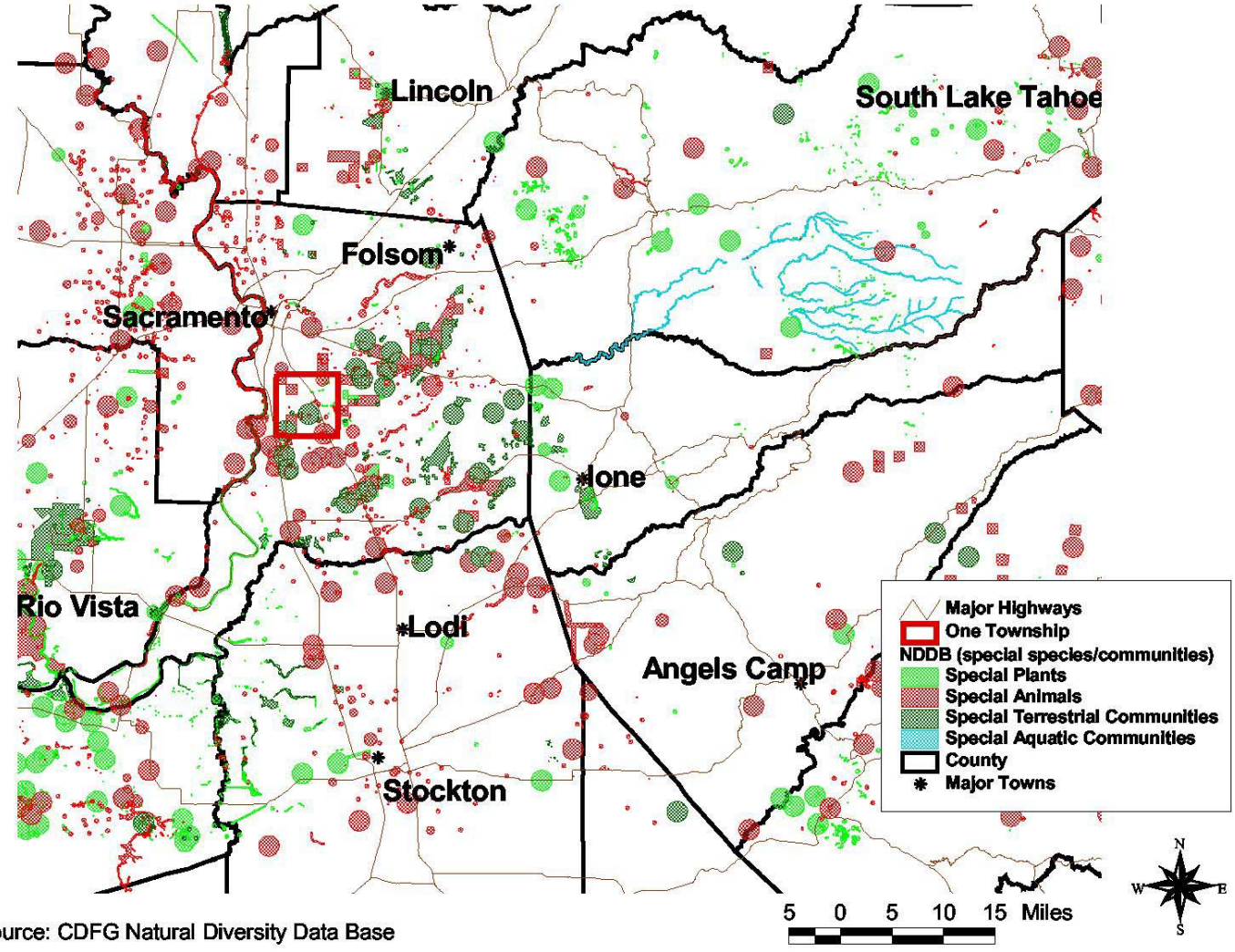
Source: UC Santa Barbara/USGS National Gap Analysis Program

Detail of GAP Public Ownership in Sacramento Region



Source: UC Santa Barbara/USGS National Gap Analysis Program

Detail of NDDB Special Species and Natural Communities in Sacramento Region



Source: CDFG Natural Diversity Data Base